OCR
Oxford Cambridge and RSA

A Level Computer Science

H446/01 Computer systems

Practice paper - Set 1

Time allowed: 2 hours 30 minutes

Do not use:
- a calculator

First name									
Last name									
Centre number						**Candidate number**				

INSTRUCTIONS
- Use black ink.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **140**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

© OCR 2016 PRACTICE PAPER OCR is an exempt Charity

Turn over

Answer **all** the questions.

1 A company releases a utility called RAMStore. The utility creates a virtual storage drive from an area of the computer's RAM.

(a) Describe what is meant by the term utility software.

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(b) Give **one** advantage of using RAM as storage in this way.

.....
.....

.....
..... **[1]**

(c) The utility periodically copies what is in the RAM drive to secondary storage, such as a hard disk. Explain why this is necessary.

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(d) It is important that enough RAM is left for the operating system to use. Describe a technique that allows operating systems to overcome a lack of available RAM.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[4]**

2 * Modern computers tend to have magnetic or solid state (flash) hard drives. Discuss which hard drive you would recommend for a keen video games player to use on their desktop PC.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[9]**

3 **(a)** Convert the unsigned binary number 11110000 to:

(i) Denary:

.....
.....

.....
.....

.....
..... **[1]**

(ii) Hexadecimal:

.....
.....

.....
.....

.....
..... **[1]**

(b) An AND operation with the mask 10101010 is applied to the binary number 01010101. Show the result.

```
01010101

10101010 AND
```

[1]

(c) An OR operation with the mask 10101010 is applied to the binary number 01010101. Show the result.

```
01010101

10101010 OR
```

[1]

(d) 00001100 is shifted two places to the left.

(i) Show the result.

.....
.....

.....
.....

.....
.....

.....
..... **[1]**

(ii) Identify what arithmetic operation this shift is equivalent to.

.....
.....

.....
.....

.....
.....

.....
..... **[1]**

(e) Convert the denary number -8 to:

(i) An 8-bit sign and magnitude binary number.

.....
.....

.....
.....

.....
.....

.....
..... **[1]**

(ii) An 8-bit two’s complement binary number.

.....
.....

.....
.....

.....
.....

.....
..... **[1]**

(f) A computer represents floating point binary numbers using a 6-bit mantissa and 4-bit exponent, both using two's complement.

Add the following three numbers together and give the answer in the format described. You must show your working.

```
010100  0010

011000  0001

100010  0010
```

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[6]**

4 Below are extracts from the ASCII and EBCDIC character sets.

ASCII

Denary Value	65	66	67	68	69	70	71	72	73	74	75	76	77
Character	A	B	C	D	E	F	G	H	I	J	K	L	M
Denary Value	78	79	80	81	82	83	84	85	86	87	88	89	90
Character	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

EBCDIC

Denary Value	193	194	195	196	197	198	199	200	201	...	209	210	211	212
Character	A	B	C	D	E	F	G	H	I	...	J	K	L	M
Denary Value	213	214	215	216	217	...	226	227	228	229	230	231	232	233
Character	N	O	P	Q	R	...	S	T	U	V	W	X	Y	Z

(a) Explain, referring to ASCII and EBCDIC, what would happen if computers were to use different character sets when communicating.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(b) Write a function that given the denary value of an EBCDIC uppercase letter, returns the denary value of an ASCII uppercase letter. If a value is entered that doesn't correspond to an uppercase EBCDIC letter the function should return -1

e.g.

`convert(201)` returns

`73`

`convert(209)`

returns `74`

`convert(78)`

returns `-1`

```
function convert(ebValue)
```

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

```
endfunction
```

[5]

5 The following is a program written using the Little Man Computer instruction set.

```
start  LDA   one
       OUT
       LDA   zero
       OUT
       LDA   count
       SUB   one
       STA   count
       BRP   start
       HLT
one    DAT   1
zero   DAT   0
count  DAT   3
```

(a) Describe the difference between the STA and LDA instructions.

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(b) Identify the type of memory addressing the program uses.

.....
.....

.....
..... **[1]**

(c) State the output this program generates.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[3]**

(d) Explain the buses and registers used when the line `SUB one` is executed.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[5]**

(e) Explain, giving an example, how pipelining in a CPU could speed up the execution of this program.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[3]**

(f) Describe **one** issue the line `BRP start` may cause for a CPU using pipelining.

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(g) Pipelining is one factor that affects the performance of a CPU. Identify **one** other factor.

.....
.....

.....
..... **[1]**

6 A company is writing a syntax checker to be used when writing HTML.

(a) The first thing the program does is add every tag in a piece of text to the data structure `dataStructureA`.

The string X is added to `dataStructureA` with the

code `dataStructureA.add("X")`

The string type variable `htmlCode` holds the code that is to have its tags added.

If `htmlCode` were to contain:
`<html><head><title>My`

`Page</title></head><body>Hello</body></html>` `dataStructureA` would

have the following contents:

`<html>`	`<head>`	`<title>`	`</title>`	`</head>`	`<body>`	`</body>`	`</html>`

Write the code to fill `dataStructureA` with the tags in `htmlCode`.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[7]**

(b) Part of the program checks that the HTML tags are well formed. Well formed HTML has tags that are nested but never overlapping. e.g.

`<p>The cat <strong>sat</strong> on the mat.</p>` is well formed.

Whereas `<p>The cat <strong>sat</p> on the mat.</strong>` is not well formed as p closes before the `strong` inside it has been closed.

All comments and single tags (e.g. `img`, `br` etc) are removed from `dataStructureA`. All attributes are removed from the within the tags.

(i) The contents of `dataStructureA` may look similar to below:

`<html>`	`<head>`	`<title>`	`</title>`	`</head>`	`<body>`	`<h1>`	`</h1>`	`</body>`	`</html>`

Tags are removed from `dataStructureA` in the same order they were added.

Identify what type of data structure `dataStructureA` is.

.....
.....

.....
..... **[1]**

`dataStructureB` is given a closing tag and gives the corresponding opening tag.

e.g.

```
openingTag=dataStructureB.get(“</head>”)

openingTag is "<head>" (courier font)
```

(ii) Identify what type of data structure `dataStructureB` is.

.....
.....

.....
..... **[1]**

The following code is used to check if the tags are well formed.

```
function checkTags(dataStructureA)
{
   valid=true
   //loops while code is still valid
   //and dataStructureA has tags
   while valid==true and dataStructureA.isEmpty()==false
      tag=DataStructureA.remove()
      //Next, check if closing tag
      if tag.substring(1,1)==”/” then
           if dataStructureC.remove()!=dataStructureB.get(tag)then
            valid=false
           endif
      else
           dataStructureC.add(tag)
      endif
   endwhile
   return valid
}
```

(iii) Identify what type of data structure dataStructureC is.

.....
.....

.....
..... **[1]**

(iv) Explain why dataStructureC is suited to checking if HTML is well formed.

.....
.....

.....
.....

.....
.....

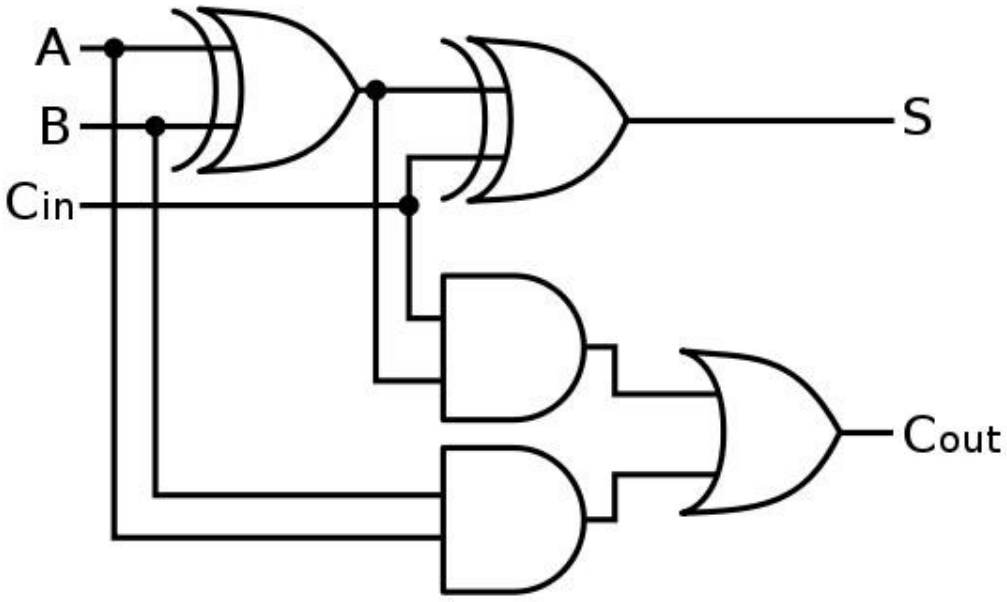
.....
..... **[2]**

7 **(a)** An XOR gate is shown below. Complete the truth table for XOR.

A	B	Q
1	1	
1	0	
0	1	
0	0	

[2]

(b) A set of logic gates are connected as below.



(i) Complete the Truth Table below:

A	**B**	**C_{in}**	**S**	**C_{out}**
1	1	1		
1	1	0		
1	0	1		
1	0	0		
0	1	1		
0	1	0		
0	0	1		
0	0	0		

[4]

(ii) Explain what the circuit does. You should refer to A,B, C_{in}, S and C_{out} in your answer.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

..... **[4]**

(c) (i) Write a Boolean expression equivalent to S. **[1]**

S ≡

(ii) Write a Boolean expression equivalent to C_{out}. **[2]**

$\mathrm{C}_{\mathrm{out}} \equiv$

8 A database stores information about songs on a music streaming service. One of the tables called Song has the fields.

`Title, Artist, Genre, Length`

(a) Explain why none of these fields would be suitable as a primary key.

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(b) Give **one** advantage and **one** disadvantage of indexing the field `Artist`.

Advantage .....
.....

.....
.....

Disadvantage .....
.....

.....
.....

[2]

(c) Users can build up playlists of their songs. Another table is created called `Playlist`.

Explain why a third table which we shall call `PlaylistEntry` is needed.
You should use an ER diagram to illustrate your answer.

[4]

(d) A band called *RandomBits* removes their permission for their songs to be streamed. The company removes all the songs belonging to *RandomBits* from their service.

(i) Identify the law with which the company are complying.

.....
.....

.....
..... **[1]**

(ii) Write an SQL statement that will remove all songs by *RandomBits* from the table Song.

.....
.....

.....
.....

.....
..... **[2]**

(iii) When the songs have been removed, explain what must happen to the table `PlayListEntry` if the database is to retain its referential integrity. (You are not expected to write the SQL to do this).

.....
.....

.....
.....

.....
..... **[1]**

9* *'Modern technology and UK laws mean privacy is dead.'*

Discuss the extent to which you agree with this statement.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[12]**

10 A software development company is building an operating system for a mobile phone that is in the process of being designed.

(a) Give **one** reason the phone needs an operating system.

.....
.....

.....
..... **[1]**

(b) Explain how the developers could use virtual machines.

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(c) One of the developers is responsible for writing the code for what happens when the CPU receives an interrupt. Outline what the code must do.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[6]**

(d) The developers follow the waterfall lifecycle.

(i) List **three** stages of the waterfall lifecycle.

1 .....
.....

.....
2.....
.....
3..... **[3]**

(ii) Justify why the waterfall lifecycle is suited to the development of the operating system.

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(iii) Give **one** disadvantage of using the waterfall lifecycle to develop the operating system.

.....
.....

.....
.....

.....
..... **[1]**

(e) * The code is written using an object-oriented programming (OOP) language. Discuss the advantages and disadvantages to the team of developers of using OOP over procedural programming. You should refer to inheritance, encapsulation and polymorphism in your answer.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[9]**

11 A website has the following HTML code.

```
<html>
<head>
<title>My Stamp Collection - European Stamps</title>
</head>
<body>
<h1 style="font-family:Arial;
color:darkGreen">United Kingdom</h1>
<p>These are my stamps from the
uk.</p> <!-- Code A -->


<!-- Code B -->

</body>
</html>
```

the site's owner wants to add the photo UKstamps.jpg in place of the comment `<!-- Code A -->`

(a) Write the code that should go in place of the comment `<!-- Code A -->`:

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(b) Where the comment `<!-- Code B -->` is, the site's owner wants to add the text:

Find out more about UK stamps

as a link to the UK Stamp Collectors Guild website which has the URL:

http://ukstampcollectorsguild.co.uk

Write the code that should go in place of the comment `<!-- Code B -->`

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

(c) The site uses styling set out as attributes in tags rather than a linked CSS file.

(i) Give **one** disadvantage of this to the site's owner.

.....
.....

.....
..... **[1]**

(ii) Give **one** disadvantage of this to the site's visitors.

.....
.....

.....
..... **[1]**

(d) The site needs a light green (web colour lightGreen) background.
Explain what change needs to be made to the current page in order to do this.

.....
.....

.....
.....

.....
.....

.....
.....

.....
.....

.....
..... **[3]**

(e) The site's owner notices that his site doesn't come up high in the results from a search engine that uses the PageRank algorithm. State what would affect his site's ranking.

.....
.....

.....
.....

.....
.....

.....
..... **[2]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s).
The question number(s) must be clearly shown in the margin(s).

OCR
Oxford Cambridge and RSA

Copyright Information:

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.
If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material OCR will be happy to correct its mistake at the earliest possible opportunity.
For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.
OCR is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.